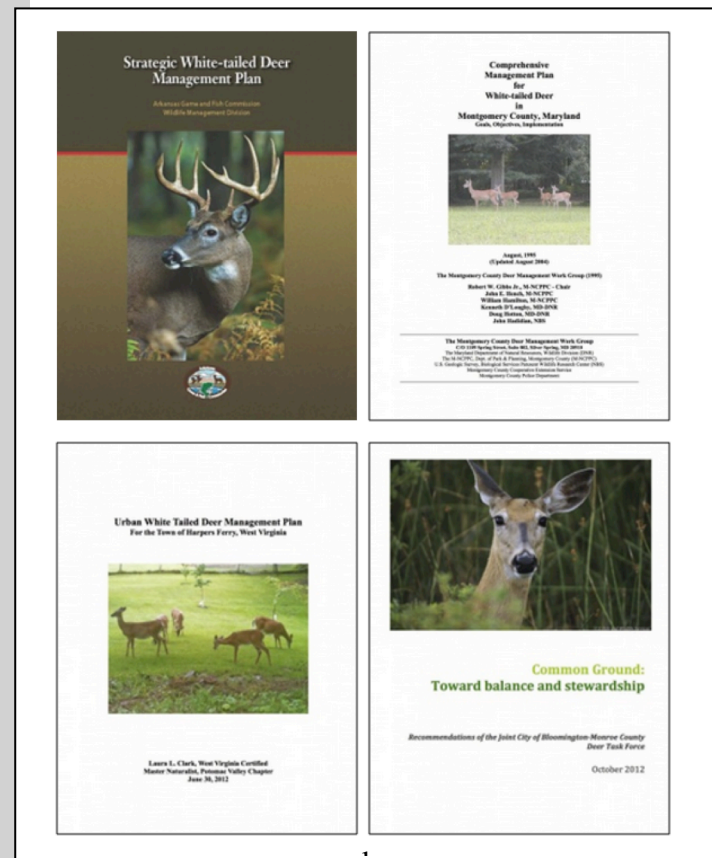

An Analysis of Community-Based Deer Management Plans



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Prepared by:

Meghan Baumer and Emily Pomeranz

Human Dimensions Research Unit
Department of Natural Resources
Cornell University

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EXECUTIVE SUMMARY

Background

White-tailed deer (*Odocoileus virginianus*) management and its associated impacts are a high-profile example of social-ecological systems management that is widespread and observable to citizens and community leaders, as well as scientists. It has been repeatedly described as a major social, ecological, and economic concern throughout the Northeast (Cote et al., 2004; Decker, Riley, & Siemer, 2012; Horsley, Stout, & DeCalesta, 2003). Excessive deer populations present a threat to biodiversity and sustainability, compounding pressure on Northeastern forest ecosystems already stressed from fragmentation, invasive species, pest outbreaks, atmospheric acid deposition and climate change.

One way wildlife managers are tackling these issues is by engaging community members in various ways to more effectively incorporate local perspectives, knowledge, and circumstances (Raik, Decker, & Siemer, 2006). This process is called community-based deer management (CBDM), and can be thought of as a form of co-management (Chase et al., 2000; Decker et al., 2004; Schusler, 1999). When wildlife managers work with communities in this co-management capacity, a clearer picture of the human-deer interactions and the primary impacts of concern emerges. In addition, co-management often fosters more support for, and satisfaction with, deer management outcomes (Decker et al., 2005).

In 2004, Decker, Raik, and Siemer published *Community-Based Deer Management: A Practitioners' Guide*. The guide includes approaches to CBDM that have been used previously, key dimensions of CBDM, and an eight-stage issue-evolution model describing the progression of deer management issues. Building off the work of the guide, HDRU collaborated with The Nature Conservancy to create the Community Deer Advisor website (deeradvisor.org), launched in 2016. This site is a resource for individuals involved or interested in deer management in their community, and is intended to help guide their progress through the process of community-based deer management. The website also includes an extensive resource library that links to articles on a variety of relevant topics such as the ecology of deer, as well as information for every step of the CBDM process and deer management. This resource library has a collection of deer management plans that communities have developed. These plans differ vastly in content and few seemed to address effectively each phase of the community-based deer management process. It was determined that a systematic review of the existing plans should be conducted to better understand and quantify their content.

Purpose

This report presents results of a systematic review of deer management plans associated with the deeradvisor.org website. Our main purpose is to understand and categorize the content that is typically included in deer management plans. This information is being used to inform the creation of an educational module aimed at assisting communities with writing deer management plans. A comprehensive, detailed plan assures that all parties involved in a CBDM process have a guide to support their deer management efforts.

Key Findings

- Thirteen of 25 plans include a stated overall purpose for the program described by the plan. Generally, these purposes focused on addressing impacts of overabundant deer and actions for mitigating deer-related problems.
- The deer problems that communities face are defined by plans in terms of the negative impacts of deer in the area. The most-frequently-mentioned impacts focus on reducing biodiversity and native plants (20%), the number of deer-vehicle accidents (20%), and damage to landscaping or gardens (20%).
- Most commonly, plans define their deer management problem using data from a deer population survey (68%), providing details on when (52%) and where (48%) the impacts are occurring, as well as descriptions of the severity of the deer-related problems (48%).
- The most commonly reported general goals of the plans are to reduce deer-related problems (35%), specifically deer-vehicle collisions (7 instances), and conduct community outreach (14%).
- Few plans include detailed, measurable objectives (36%). Plans that include some measurable objectives tend to refer to: reducing Lyme disease cases, reducing deer vehicle collisions, reducing crop loss, reducing landscape damage, herd size goals (deer per square mile), or wildlife acceptance capacity. Most commonly, if objectives are reported, they focus on deer-population objectives (6 instances) or deer-vehicle-collision-reduction objectives (4 instances).
- All 25 plans include a list of actions that are recommended or selected for implementation. The most common actions relate to public education and awareness, followed by information gathering and monitoring. With respect to these actions, only 16% of the plans describe how the actions selected will meet the objectives of the plan. Most of the plans (60%) identify who will carry out the objectives; 28% identify responsible parties for some of the actions; and 12% do not identify any responsible parties.
- Most deer management plans include some information regarding public outreach efforts (88%). While 44% of plans include some indicators for monitoring, it is notable that only 32% of plans have details on those indicators, and even less—8%—link those indicators to measurable objectives.
- Only five of the 25 plans (20%) include a budget. However, 40% of plans report some one-time costs, often within the body of the plan and not necessarily as part of a specific budget. Timetables appear in 44% of the plans.
- Plans were reviewed for designation of who would be responsible for certain elements of implementation; most (88%) plans mention at least one responsible party. Many of the plans (35.6%) list “the city” as the entity responsible for implementing the deer management plan.

Discussion and Next Steps

Overall, many deer management plans were incomplete. Using our understanding from this analysis of content typically present or missing in community-based deer management plans,

will be used to develop an educational module to aid community leaders, planning process facilitators, and deer management professionals in writing a community-based deer management plan. In identifying gaps in plans (e.g., absence of goals and measurable objectives; lack of a plan for monitoring, budget, and timetable), the results of this analysis suggest content not to overlook or to emphasize when developing comprehensive, well-reasoned plans. As state wildlife agencies and communities continue to rely on local-level processes to address increasing impacts of deer-human interactions (Chase et al., 2000), providing tools such as an educational module for developing a community-based deer management plan is one way to support capacity building for these CBDM processes.

Based on the review of community-based deer management plans, it is recommended that an educational module on writing deer management plans should have particular focus on developing goals and measurable objectives with associated indicators for monitoring, as many of the plans reviewed do not have these elements. Upon completion, this module should be available as a resource on the Community Deer Advisor website (deeradvisor.org) for communities to use as they update or create new management plans.

ACKNOWLEDGMENTS

We appreciate support of our collaborators on the Community Deer Advisor website (deeradvisor.org); Meredith Cornett of The Nature Conservancy, Daniel Decker and William Siemer of Cornell's HDRU, Nicholas Hollingshead of Cornell's Animal Health Diagnostic Center and Hi'ilei Casco an Environmental and Sustainability Sciences major at Cornell. Paul Curtis from the Department of Natural Resources at Cornell also provided continuous guidance on this project.

We also want to thank all the communities that were willing to be featured as community examples and included their deer management plans on the Community Deer Advisor website. By posting their information, other communities and academics can learn from their experiences.

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TABLE OF CONTENTS

Executive Summary	i
Acknowledgments	iv
List of Tables	vi
List of Figures	vii
Introduction	1
Background	1
Purpose	3
Methods	3
Findings	4
Management Plan Descriptions	4
Problem Definition	8
Goals and Measurable Objectives	11
Management Actions Recommended and Considered	14
Plan for Public Engagement and Monitoring	15
Budget and Timetable	16
Responsibility and Supporting Documentation	18
Discussion	21
Next Steps	21
Literature Cited	23
Appendix A	25
Appendix B	30
Appendix C	34

LIST OF TABLES

Table 1. Coded plans summary.....	5
Table 2. Data on the number of deer management plans that include certain background elements.	6
Table 3: Deer management plan purposes.	7
Table 4: Primary impacts of deer in communities from deer management plans.	8
Table 5: Data on the number of percentages of deer management plans that include certain problem definition elements	10
Table 6: Decrease deer-related problems goal subcategories	11
Table 7: Community outreach goal subcategories.....	11
Table 8: Data on the number of percentages of deer management plans that include certain public engagement and monitoring elements.	15
Table 9: Data on the number and percentages of deer management plans that include budget and timetable elements.	16

LIST OF FIGURES

Figure 1. Community-based deer management process.	3
Figure 2: Graphic of impact categories mentioned in the deer management plans.	9
Figure 3: Graphic of the most commonly-cited sources listed in the deer management plans. ...	10
Figure 4: Graphic of budget items mentioned in the deer management plans.	17
Figure 5: Graphic of the entities responsible for deer management plan implementation.	19
Figure 6: Graphic of the supporting documentation that appeared at least twice in the deer management plans.	20

INTRODUCTION

Background

White-tailed deer (*Odocoileus virginianus*) management and its associated impacts are a high-profile example of social-ecological systems management that is widespread and observable to citizens and community leaders, as well as scientists. It has been repeatedly described as a major social, ecological, and economic concern throughout the Northeast (Cote et al., 2004; Decker, Riley, & Siemer, 2012; Horsley, Stout, & DeCalesta, 2003). The impacts of overabundant deer populations are evident to communities that experience increased outbreaks of Lyme disease and other tick borne illnesses for which deer are hosts (Kilpatrick, Labonte, & Stafford, 2014), farmers who experience lost crops and associated income due to deer feeding (Stewart, McShea, & Piccolo, 2007), and ecologists and landowners/managers who work in forests where plant diversity and structure are markedly changed by deer herbivory (Aronson & Handel, 2011; Rooney, 2008). Excessive deer populations threaten biodiversity and sustainability, compounding pressure on Northeastern forest ecosystems already incurring impacts from fragmentation, invasive species, pest outbreaks, atmospheric acid deposition, and climate change. Even mainstream media outlets have described the impacts of deer populations as a crisis; as written in a Bloomberg News article about the deer issue: “Looking over the American landscape, it’s hard to think of a more insidious threat to forests, farms and wildlife, not to mention human health and safety, than deer” (2012, August 9). The rise in overabundant deer populations and their associated human-deer interactions—compounded by suburban growth patterns that are hospitable for deer to thrive—has resulted in a desire by community leaders, residents, and wildlife managers to address human-deer interactions and their associated impacts at the local level (Chase, Schusler, & Decker, 2000; Decker, Raik, & Siemer, 2004; Raik, Decker & Siemer, 2003).

Historically, wildlife managers tended to manage deer populations on a large geographic level. However, the increase in deer population density in many areas has created what citizens regard as local problems leading them to be more vocal as local communities. This, coupled with trends towards increasing stakeholder participation in management and decision making in wildlife management generally, has led deer managers to recognize the need to increase their capacity for community engagement so they can respond to stakeholder desires for more input in management of local deer (Leong et al., 2009; Raik et al., 2003). Managers are engaging community members in various ways to more effectively incorporate local perspectives, knowledge, and circumstances (Raik, Decker, & Siemer, 2006). This process is called community-based deer management (CBDM), and can be thought of as a form of co-management (Chase et al., 2000; Decker et al., 2004; Schusler, 1999). Co-management refers to “the sharing of power and responsibility between government and local resource users” (Berkes, George, & Preston, 1991, p. 12). Chase et al. (2000) emphasize that co-management reflects a partnership arrangement, where wildlife managers do not give up their authority and legal responsibility for deer management, but rather work with communities to help determine what roles and responsibilities may be appropriate for various entities in managing a local deer-management problem, thereby increasing capacity to manage deer at the local level. These entities can include municipal leaders, nonprofit organizations, state and federal wildlife agencies, universities, stakeholder organizations, private firms or consultants, as well as local

residents. When wildlife managers work with communities in this co-management capacity, a clearer picture of the human-deer interactions and the primary impacts of concern emerges. In addition, there is often more support for, and satisfaction with, deer management outcomes (Decker et al., 2005).

In 2004 Decker, Raik, and Siemer published *Community-Based Deer Management: A Practitioners' Guide* “to enable the continued management of white-tailed deer as a resource, rather than as a pest, by articulating key dimensions of success when engaging in community-based management” (p. 4). The guide includes approaches to CBDM that have been used previously, key dimensions of CBDM, and an eight-stage issue-evolution model describing the progression of deer management issues based on the work of Hahn (1990). Building off the guide, HDRU collaborated with The Nature Conservancy to create the Community Deer Advisor website (deeradvisor.org), launched in 2016. This site is a resource for individuals involved or interested in deer management in their community, and is intended to help guide their progress through the process of community-based deer management (Figure 1). It has a detailed description of the process of CBDM that is based on social science research and examples from communities that have undergone CBDM efforts. An extensive resource library links to articles such as the ecology of deer, as well as information for every step of the CBDM process and deer management. The resource library has a collection of deer management plans that communities have developed, as well as a template for developing a CBDM plan. These plans differ vastly in content and few seemed to address effectively each phase of the community-based deer management process. This observation led to a systematic review of the existing plans to better understand and quantify their content.

For the Community Deer Advisor website, the eight-stage issue-evolution model described in Decker et al.'s (2004) practitioners' guide was repackaged as a four-phase process (Figure 1). The four phases include:

1. **Problem definition:** a community gathers information to assess the deer situation and the full scope of the problem.
2. **Decision making:** management alternatives are considered and actions are recommended.
3. **Implementation:** a deer-management plan is developed
4. **Evaluation and Adaptation:** the community gathers information to track success of the program. If needed, management objectives and approaches are adapted based on program evaluations.

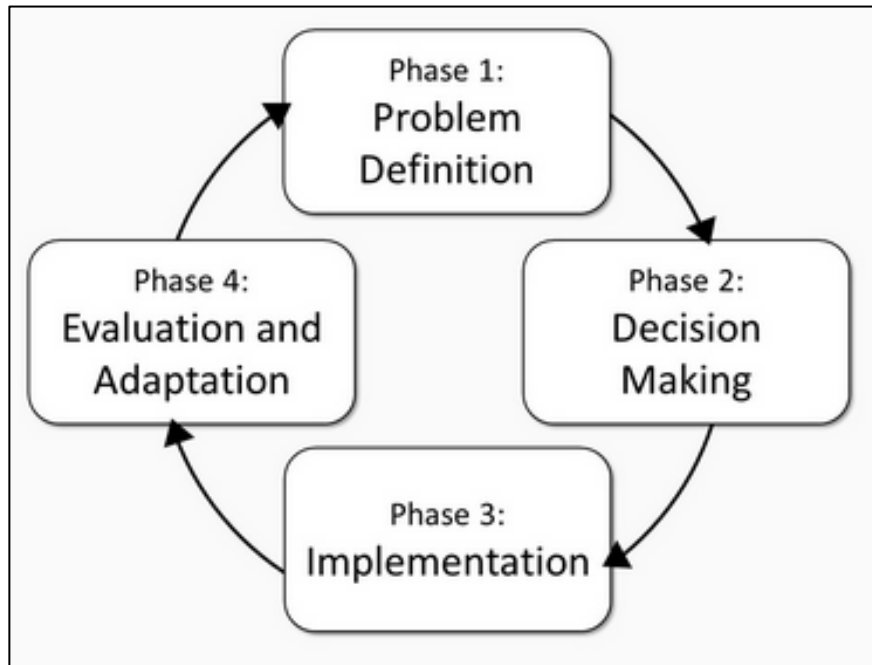


Figure 1. Community-based deer management process.

Purpose

This report presents results of a systematic review of the existing deer management plans associated with the deeradvisor.org website. The main purpose is to understand and categorize the content typically found in CBDM plans. This analysis will inform revisions to the deer management template available on the website and expand that template into an educational module to aid community leaders, process facilitators, and deer management professionals in the development of a CBDM plan. While not every community develops a formal deer management plan, choosing to do so may be helpful in organizing decisions about goals, objectives, and actions associated with any CBDM program. A plan can help communicate why particular actions were selected, how those actions meet a community's goals and objectives for deer management, and how progress on goals will be tracked and evaluated. Our evaluation of deer management plans and use of that evaluation in development of a deer management planning educational module is aimed at helping ensure the transparency and accountability of CBDM planning. The creation of a comprehensive, detailed plan assures that all parties involved in a CBDM process have a guide to achieving their deer management goals and objectives.

METHODS

Deer management plans were obtained from the Community Deer Advisor website in the [resources section](#), which were identified by a combination of voluntarily-offered plans by community example contributors as well as a web search for deer management plans associated with the website's map of existing community-based deer management programs. The mapped deer management programs were initially identified through personal communication with wildlife professionals and research by The Nature Conservancy. Twenty-five plans were coded

during the months of April and May, 2017. A coding protocol (Appendix A) was created based on a deer management plan template (Appendix B) designed for the Community Deer Advisor website. The template on which the protocol was initially based was developed by reviewing existing deer management plans and consulting with a deer management planning expert in Natural Resources Extension at Cornell University. Inter-coder reliability was tested by having two coders analyze the Hopewell Valley, NJ plan. Results of both coders were reviewed for consistency. A few coding items were added to the protocol after this initial inter-coder reliability test. Subsequently, the two coders divided the deer management plans and coded them independently. Codes were recorded and analyses were conducted in Microsoft Excel.

FINDINGS

The bold sub-headings in this section reflect the deer management plan template found in Appendix B and the coding protocol found in Appendix A.

Management Plan Descriptions

Management plans included in this analysis are from a number of communities across the United States. See Table 1 for a full listing of locations. These plans were written between 2002 and 2016. The page lengths range between 2 and 1,737 pages long (these page lengths include appendices and supplemental materials).

Eighteen plans indicate the plan's authors. Of those, half are authored by a deer task force or committee (the numbers refer to the number of plans):

- Deer task forces or committees: 9
- Municipality, city administrator, or board of trustees: 3
- Police department: 1
- State wildlife agency: 1
- City parks department: 1
- Master naturalist program: 1
- Private consultant: 1
- Other: 1

Several plans also indicate that the authors received some assistance in development of the plan. Assistance is often attributed to state wildlife or environmental agencies as well as local municipal offices. Specifically, assistance was provided by (the numbers refer to the number of plans):

- State environmental agency: 5
- Municipal departments and personnel (including commissions, boards, etc.): 5
- Land trust: 1
- Nonprofit organizations: 2
- National park: 1

- Police department: 1
- Private residents: 1
- Private consultant: 1

Table 1. Coded plans summary.

Plan Name	Location	Authored By	Length (pages)
Town of Amherst Deer-Vehicle Accident Management Plan	Amherst, NY	White Water Associates	74
Recommendations for Deer Management in Ann Arbor	Ann Arbor, MI	Community Services Area Administrator and City's Communication Director	1737
Common Ground: Toward Balance and Stewardship	Bloomington, IN and Monroe County	Joint City of Bloomington-Monroe County Deer Task Force	209
2003-2004 Deer Management Implementation Plan	Brooklyn Center, MN	Brooklyn Center Deer Task Force	6
Burnsville Deer Management Program	Burnsville, MN	City of Burnsville	57
Final Environmental Impact Statement Deer Management Plan Village of Cayuga Heights	Cayuga Heights, NY	Village of Cayuga Heights Board of Trustees	411
City of Clinton Deer Management Program	Clinton, IA	City of Clinton Deer Management Committee	3
2016/17 Proposed Urban Deer Reduction Plan	Cody, WY	Cody Police Department	5
City of Eau Claire Urban Deer Management Plan	Eau Claire, WI	John C. Dunn	36
City of Galena - 2015 Deer Committee Final Report to the City Council	Galena, IL	City of Galena Deer Committee	32
Report on Managing Greenwich's Deer Population	Greenwich, CT	Town of Greenwich Conservation Commission	12
Urban White Tailed Deer Management Plan for the Town of Harpers Ferry, WV	Harpers Ferry, WV	Master Naturalist of the Potomac Valley Chapter	15
Montana Fish, Wildlife and Parks Draft Programmatic Environmental Assessment City of Helena Urban Deer Management Plan	Helena, MT	Montana Fish, Wildlife, and Parks	13
City of Hendersonville Tennessee Urban Deer Report	Hendersonville, TN	Hendersonville Urban Deer Committee	12
Hopewell Valley Deer Management Plan	Hopewell Township, NJ	Hopewell Valley Deer Management Task Force	56

Howard County Department of Recreation and Parks Comprehensive Deer Management Plan	Howard County, MD	Unknown	23
Comprehensive Management Plan for White-tailed Deer in Montgomery County, Maryland	Montgomery County, MD	The Montgomery County Deer Management Working Group	35
Urban Deer Management Plan	Onalaska, WI	Unknown	3
The City of Oxford Deer Management Plan	Oxford, MS	Unknown	32
City of Pewaukee Urban Deer Management Plan	Pewaukee, WI	Unknown	3
City of Rochester Hills Deer Management Advisory Committee Recommendations for 2012	Rochester Hills, MI	Unknown	12
White-Tailed Deer Management Plan	Rockville, MD	White-Tailed Deer Task Force	17
City of Roseville: Deer Population Management Program and Policy	Roseville, MN	Unknown	2
Deer Management Plan: City of Solon	Solon, IA	Unknown	15
Metroparks Toledo 2016-2017 Deer Management Plan and Request for Deer Damage Control Permit	Toledo, OH	Metroparks Toledo	33

Deer management plans were coded for the presence of certain background elements (Table 2). For a description of the coded elements, see Appendix A. Among plans that include background elements, a majority present information on the land ownership (i.e. public land, private land, both; 76%) and land type (e.g., state park, county park, city park, neighborhood, private residence, private woodland, agricultural land, etc., 64%) of the community. Few provide information on the community size (12%) or have an overall plan summary (24%).

Table 2. Data on the number of deer management plans that include certain background elements.

Background Elements	# plans include	% plans include
Land ownership	19	76%
Land type	16	64%
Plan coverage area	10	40%
Community size	3	12%
Overall plan summary	6	24%
Purpose	13	52%
Deer history	12	48%
Plan history	12	48%

The coverage area of the plans range from 0.6 to 62.4 square miles, and community sizes range from 285 to 54,000 residents. The plans that include land ownership mention both private and public lands. Land types mentioned were (the numbers refer to the number of plans):

- Residential/Private Property: 11
- City/Urban Parks, Nature Preserves, Natural Areas or Green Spaces: 10
- City/Urban Property: 6
- Rural Areas: 2
- Commercial, Industrial, or Retail Property: 2
- Suburban Areas: 1
- County Land: 1
- Roads: 1
- National Park: 1
- Unspecified: 10

Thirteen plans include a stated purpose for the plan. Generally, these purposes focus on addressing impacts of overabundant deer and actions for mitigating deer-related problems. See Table 3 for purpose categories (“Addresses Impacts” and “Addresses Actions” are not mutually-exclusive; subcategories are mutually-exclusive).

Table 3: Deer management plan purposes.

Purpose Categories	# of Plans	Example
(1) Addresses Impacts		
<i>Mitigate Specific Impacts</i>	5	“The Town of Amherst Deer-Vehicle Accident Management Plan provides a practical, systematic, integrated, and adaptive approach for managing deer-vehicle accidents (DVAs) at levels reflecting public involvement through the New York State Environmental Quality Review process.” [Amherst, NY]
<i>Mitigate Impacts Generally</i>	3	“A comprehensive plan addressing resident and ecological concerns while necessitating efficient and effective herd management.” [Solon, IA]
(2) Addresses Actions		

<i>Take A Specific Action [lethal control]</i>	1	“The City of Cody has established an Urban Deer Task Force to consider ways to handle the deer population in the City of Cody. As of September 17, 2016, Cody City Council, while considering the approval of a lethal reduction program to address the local urban deer population, has instructed the Cody Police Department to draft a preliminary operational plan, first year budget, and to pursue the Chapter 56 permit from the Wyoming Game and Fish Department.” [Cody, WY]
<i>Discusses Deer Population Control Generally</i>	4	“A program designed to control excess deer within the city limits of Clinton.” [Clinton, IA]
<i>Discusses Guidance and Planning Generally</i>	4	“Determine the goal of the deer management program, the deer management area, and the preferred deer management methods.” [Ann Arbor, MI]

Problem Definition

The deer problems that communities are facing are defined by plans in terms of the negative impacts of deer in the area. The primary impacts mentioned in the deer management reports are included in Table 4. Percentages reflect the percent of all total impacts mentioned across plans (e.g., 20% of the impacts mentioned across all plans are related to biodiversity/native plants; this does not mean that 20% of plans mentioned biodiversity/native plants). The most-mentioned impacts focus on biodiversity and the reduction of native plants (20%), the number of deer-vehicle accidents (20%), and damage to landscaping or gardening (20%).

Table 4: Primary impacts of deer in communities from deer management plans.

Impact	%
Biodiversity/native plants	20
Deer-vehicle accidents	20
Landscape/garden damage	20
Lyme Disease	13
Deer human interactions	6
Agriculture	3
Deer health	3
Carrying capacity	2
Chronic Wasting Disease	2
Deer feces	2
Deer pet interactions	2

Deer aggression	1
Disease transmission (general)	1
Human anxiety	1
Human health	1
Nuisance complaints	1
Safety	1
Spread ticks	1

These impacts were then categorized into deer health, ecological, economic, human health, pet safety and public safety (Figure 2). Public safety (28%) is the most-frequently-mentioned impact category in the coded deer management plans.

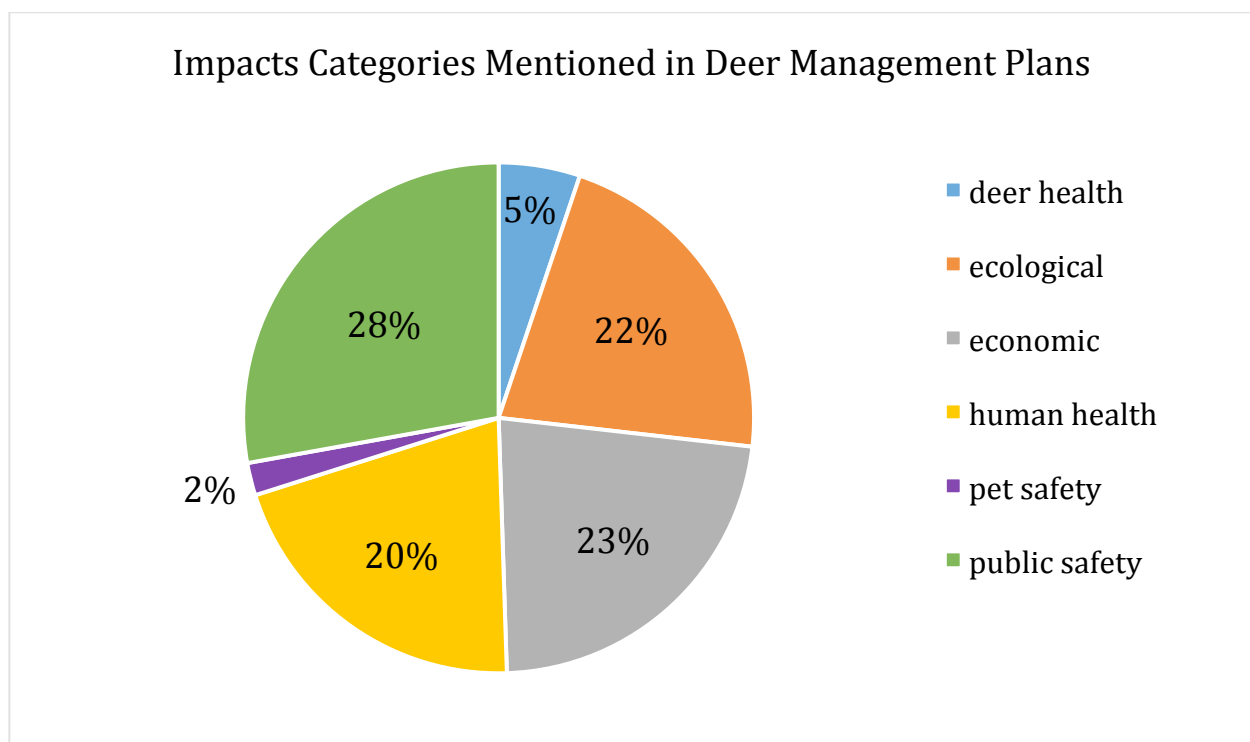


Figure 2: Graphic of impact categories mentioned in the deer management plans.

As with the preceding section, the presence or absence of several problem definition elements were coded (Table 5). Most commonly, plans define their deer management problem by conducting or using data from a deer population survey (68%), providing details on when (52%) and where (48%) the impacts are occurring, as well as descriptions of the severity of the deer-related problems (48%).

Table 5: Data on the number of percentages of deer management plans that include certain problem definition elements

Problem Definition Elements	# of plans include	% of plans include
Details on when the impacts are occurring	13	52
Details on where the impacts are occurring	12	48
Details on who the impacts are affecting	10	40
Severity of the problems	12	48
Conducted or used data from a deer population survey	17	68
Conducted or used data from a public survey	8	32
Conducted or used data from a forest monitoring survey	6	24

Plans cite multiple sources for informing their management problem definition and quantifying impacts (Figure 3). Local police departments are cited most frequently as sources (16% of the plans), often providing information on deer-vehicle collisions. Citizen input (i.e., through public meetings or surveys) was used to define the deer management problem in 14% of plans. Health departments provided data on Lyme disease in 14% of plans. Other sources include deer-vehicle accident reports, aerial deer surveys, insurance companies, and academic research. For a list of sources that were included in only one deer management plan, see Appendix C.

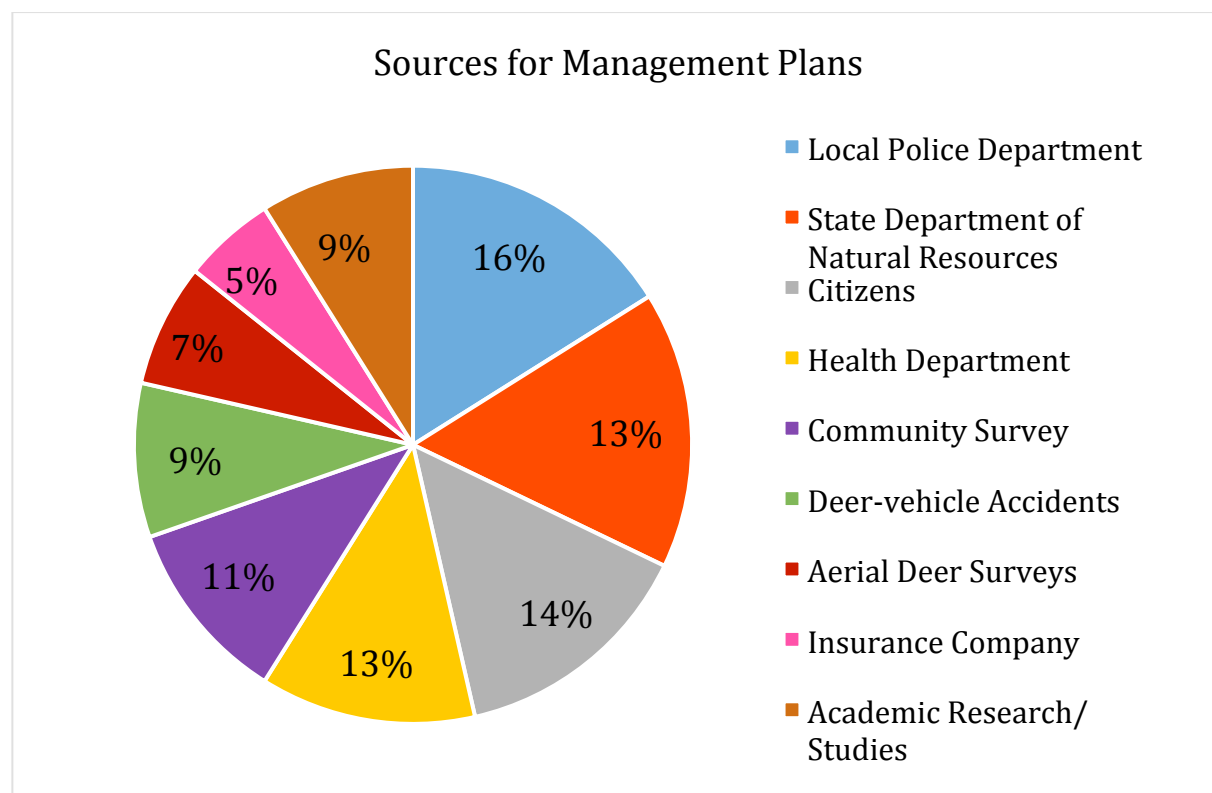


Figure 3: Graphic of the most commonly-cited sources listed in the deer management plans.

Goals and Measurable Objectives

Goals

The general goals listed in the plans are presented below, organized by themes. Tables are provided for the most-commonly reported goals: to reduce deer-related problems (35% of plans), specifically deer-vehicle collisions (7 instances), and to conduct community outreach (14% of plans) (Tables 6 and 7). These two common goal categories have been coded into subcategories, which are included in the tables. Following the two tables, less-commonly reported goals are listed. Percentages listed are out of the entire suite of general goals mentioned in the plans; some plans had multiple goals listed.

Table 6: Decrease deer-related problems goal subcategories

Decrease Deer-Related Problems (35%)

Sub-category	# of instances	Example
Reduce Deer-Vehicle Collisions	7	Decrease risk of deer-vehicle collisions.
Reduce Landscape Damage	4	Preserve and protect the land of property owners.
Reduce Ecological Damage	4	Reduce environmental damage, including damage to local species like oak trees, trillium, song birds, etc.
Maintain Public Health and Safety Generally	3	Ensure the safety and welfare of inhabitants of the city.
Reduce Deer Damage Generally	2	Document and mitigate damage caused by deer.
Reduce Resident Complaints	1	Decrease the number of resident complaints and encounters.
Reduce Woodland Damage	1	Reduce wooded area damage.
Reduce Deer Herding	1	Discourage deer herding within town limits.
Reduce Lyme Disease Rate	1	Decrease the Lyme disease rate.

Table 7: Community outreach goal subcategories

Community Outreach (14%)

Sub-category	# of instances	Example
Development of Education and Outreach Program	3	Develop an educational program to provide citizens with information about deer biology, currently available methods to minimize deer/human conflicts on private property, and ongoing public management activities.
Enhance Community Awareness Generally	3	Make educational materials available to each interested citizen.
Promote Deer-Resistant Landscaping and Barriers	1	Promotion of deer resistant landscaping and barriers.
Annual Reporting	1	Issue annual reports to update the community and

		local officials on the status of the project.
Development of Educational Materials	1	Develop a community oriented set of controls that will limit or reduce the growth of the deer population. These controls must take into account the need for public safety, the protection of physical property from damage, and the cost effectiveness of the selected control measure(s).
Convene Regular Community Meetings	1	Provide community meetings and seminars to educate the general public on how humans and wildlife interaction.

Deer Reduction: (11%)

- Example: “Reduced and stable deer herd in approximately 3-5 years.”

Manage or Monitor Deer: (8%)

- Example: “Due to the abundance of complaints expressed to the City by residents, the City seeks to monitor and manage the deer population.”

Ensure Peaceful Co-Existence with Deer: (8%)

- Example: “Create an acceptable environmental balance that will facilitate the co-existence of citizens and wildlife.”

Obtain More Data: (6%)

- Example: “Identify the nature and extent of problems caused by deer and recommend any appropriate solution”

Ensure Deer Health: (4%)

- Example: “Maintain a stable, balanced deer population within acceptable limits of biological and cultural carrying capacities.”

Develop Deer Management Plan or Program: (4%)

- Example: “Develop and implement a long-range deer management plan based on scientific information and community needs.”

Keep Informed: (3%)

- Example: “Keep current on state wildlife policies and updated methods of population control.”

Review or Develop Ordinances: (3%)

- Example: “Recommend and develop ordinances as appropriate.”

Develop Task Force: (1%)

- Example: “Develop a Wildlife Task Force that will monitor and update the management plan on a regular basis. This task force will provide input for the update of the management plan as the community’s needs and development change and work with city personnel designated to administer this plan.”

Venison Donation: (1%)

- Example: “Provide interested citizens with venison from harvested deer so they are not wasted.”

Measurable Objectives

Few of the plans have detailed, measurable objectives (36%). Measurable objectives in those plans address: Lyme disease case reduction, deer vehicle collision reduction, crop loss reduction, landscape damage reduction, herd size goals (deer per square mile), or wildlife acceptance capacity. Most commonly, if objectives are reported, they tend to focus on deer population objectives (6 instances) or deer-vehicle collision reduction objectives (4 instances). The following measurable objectives were coded:

Deer Population Objectives: (6 instances)

- Example: “Reduce deer population density to 25 deer per square mile.”

Deer-Vehicle Collision Reduction: (4 instances)

- Example: “Keep average number of deer vehicle accidents at the level of 35 annually or below.”

Lyme Disease Reduction: (1 instances)

- Example: “The Task Force recommends a 25% reduction goal by 2013 (128 cases) and a 75% reduction goal by 2019 (43 cases).”

Crop Loss Reduction: (1 instance)

- Example: “The public questionnaire results suggested that 27% of respondents had crop losses exceeding \$5,000 per year. The Task Force recommends a 25% reduction goal by 2013 (20% of respondents) and a 75% reduction goal by 2019 (7% of respondents).”

Landscape Damage Reduction: (1 instance)

- Example: “The public questionnaire results suggested that 55% of respondents had severe or moderate landscape damage. The Task Force recommends a 25% reduction goal by 2013 (41% of respondents) and a 75% reduction goal by 2019 (14% of respondents).”

Wildlife Acceptance Capacity: (1 instance)

- Example: “Track wildlife acceptance capacity of citizens to understand maximum acceptable level of deer in city: attain light or no impact to questions 3 and 4 of the survey from 80% of respondents.”

None of the plans have any goals connected to those established outside the community-based deer management plan, such as statewide deer management goals.

Management Actions Recommended and Considered

All 25 plans include a list of actions that are recommended or selected for implementation. The most common actions reported are related to public education and awareness, followed by information gathering and monitoring. With respect to these actions, only 16% of the plans have a description of how the actions selected will meet the objectives of the plan. Most of the plans (60%) identify who will carry out the objectives; 28% identify responsible parties for some of the actions, and 12% do not identify any responsible parties. In addition, many of the plans (72%) include a description of actions that were considered but ultimately not recommended for implementation.

Listed below are themes that emerged with respect to actions recommended. Percentages reflect the percent of all total actions mentioned across plans (e.g., 23.9% of the actions mentioned across all plans are related to community education; this does not mean that 23.9% of plans mentioned community education).

Public Education and Awareness

- Community Education **23.9%**
- Construct Deer Warning Signs **2.3%**

Information Gathering and Monitoring

- Collect More Information **19.2%**
- Establish Guidelines for Reaching Goals **1.4%**
- Monitor Deer Health **1.4%**
- Government Education **0.9%**
- Evaluate Deer Management Plan **0.9%**
- Deer Management Committee **0.9%**
- Monitor Harvested Deer **0.5%**
- Update on Deer Management Efforts **0.5%**

Lethal Control

- Deer Removal (gun) **5.2%**
- Deer Removal (culling- no mention specifics) **4.7%**
- Deer Removal (archery) **4.2%**
- Deer Removal (gun or archery) **0.5%**

Nonspecific Actions

- Reduce Deer-Vehicle Accidents **7.0%**
- Address Deer Problems **0.9%**
- Deer Removal (no details) **0.9%**
- Protect Wooded Areas **0.9%**

- Use Data to set Deer Harvest **0.9%**
- Decisions Based on Best Management Practices **0.5%**

Hunting-Focused

- Improve Hunting Access **4.2%**
- Improve Hunting Efficacy **2.3%**

Nonlethal Control

- Ban Deer Feeding **2.8%**
- Deer Sterilization **1.4%**
- Fencing **0.9%**

Legal Changes

- Legislation/regulation **0.5%**
- Ordinances **1.4%**

Permitting

- Nuisance Permits **0.9%**
- Deer Management Permit **0.5%**

Other

- Work with others on Deer Management **3.8%**
- Venison Donation **1.9%**
- No Deer Reduction **0.9%**
- Obtain Funding for Deer Management **0.5%**

Plan for Public Engagement and Monitoring

Plans were coded for details about informing community members of the deer management decision-making process and using indicators for monitoring progress (Table 8). Most deer management plans include some information regarding public outreach efforts (88% of plans). While 44% of plans include some indicators for monitoring, it is notable that only 32% of plans have details on those indicators, and even less—8%—link those indicators to measurable objectives.

Table 8: Data on the number of percentages of deer management plans that include certain public engagement and monitoring elements.

Public Engagement and Monitoring Elements	# of plans include	% of plans include
Details on public outreach	22	88
List of indicators for monitoring progress	11	44

Indicator details	8	32
Indicators connected to objectives	2	8

Budget and Timetable

Plans were coded for information regarding budgets and timelines for implementation (Table 9). Only five of the 25 plans (20%) include a budget. However, 40% of the plans report some one-time costs, often within the body of the plan and not necessarily as part of a specific budget. Timetables are only included in 44% of the plans.

Table 9: Data on the number and percentages of deer management plans that include budget and timetable elements.

Budget Elements	# of plans include	% of plans include
Presence of a budget	5	20
One-time costs	10	40
Recurring costs	5	20
Dates for elements of the plan	11	44

The items mentioned in budgets were coded and grouped by theme (Figure 4). The two most frequent items listed in the deer management plan budgets are for data collection (23%) and some form of deer population control (23%).

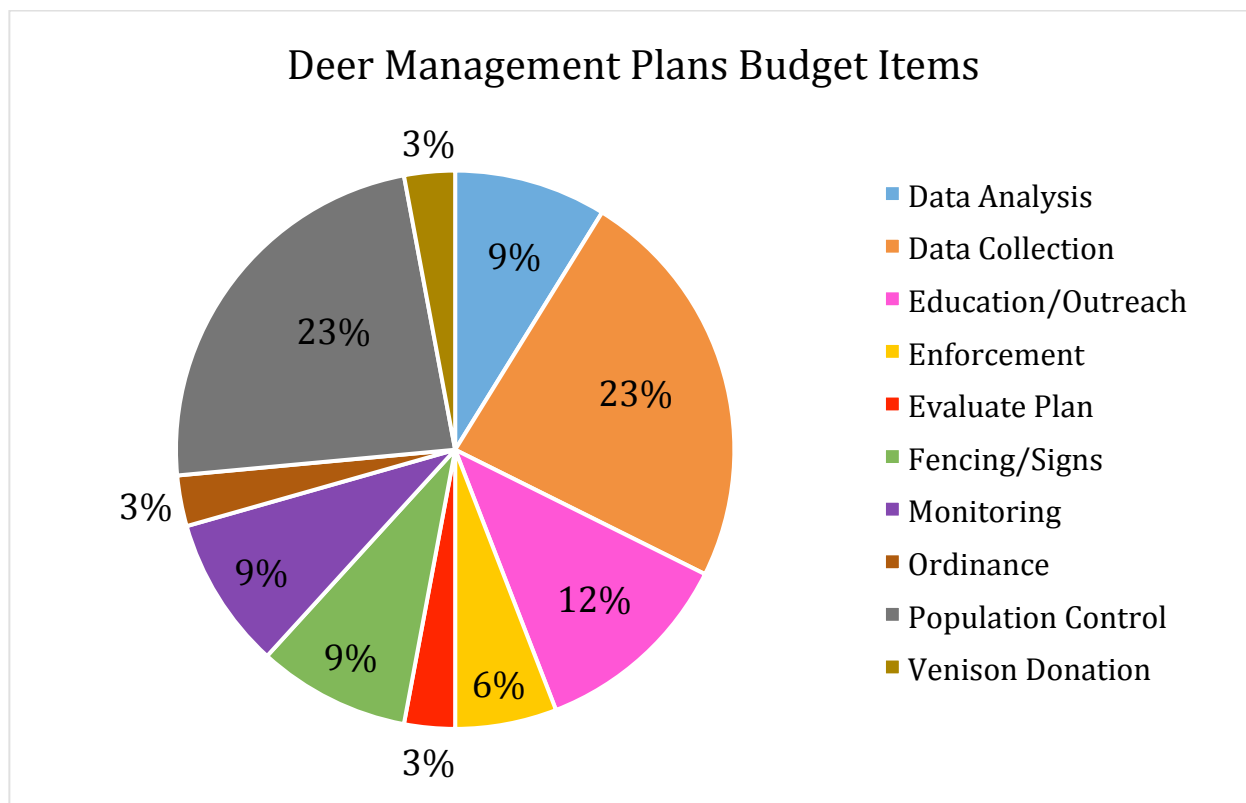


Figure 4: Graphic of budget items mentioned in the deer management plans.

Timetables in plans have the following elements:

Monitoring Actions: (6 instances)

- Example: “Monitor complaints, crashes and review sharpshooting results. Review and update archery hunting provisions and locations, if necessary.”

Lethal Control Implementation: (5 instances)

- Example: “Implement culling program between Jan-Mar 2017.”

Deer Population Counts: (3 instances)

- Example: “Aerial deer surveys after culling operation.”

Education/Outreach Efforts: (3 instances)

- Example: “Installing deer crossing signs.”

Plan Adoption or Adjustment: (3 instances)

- Example: “On an annual basis, update the information in Table 1-A to reflect the latest year’s information on deer counts, DVA, and number of deer removed as part of the Program.”

Deer-Vehicle Collision Analyses: (2 instances)

- Example: “Annually document the number of DVA in the City. The goal is 35 DVA a year.”

Other Data Collection: (2 instances)

- Example: “Inventory and analyze the locations of existing deer crossing signs within the City. Are these signs appropriately located? Are they effective? Are fewer signs warranted? Are additional signs warranted? Are other types of warning signs appropriate? (Winter of 2015).”

Resident Survey: (2 instances)

- Example: “Based on survey information provided by residents and businesses, establish a baseline for the WAC of deer in each section of the City.”

Management Site Selection: (2 instances)

- Example: “Identify specific locations for sharpshooting.”

Nonlethal Control Implementation: (1 instance)

- Example: “Feeding ban continuation timing.”

Other: (2 instances)

- Instance 1: “Reduce deer population to 26 deer per square mile within 3-5 years.”
- Instance 2: “Deer herd control consideration.”

Responsibility and Supporting Documentation

Plans were reviewed for listings of who would be responsible for certain elements of implementation. Most (88%) of plans mention at least one responsible party (Figure 5). Many of the plans (35.6%) list “the city” as the entity responsible for implementing the deer management plan.

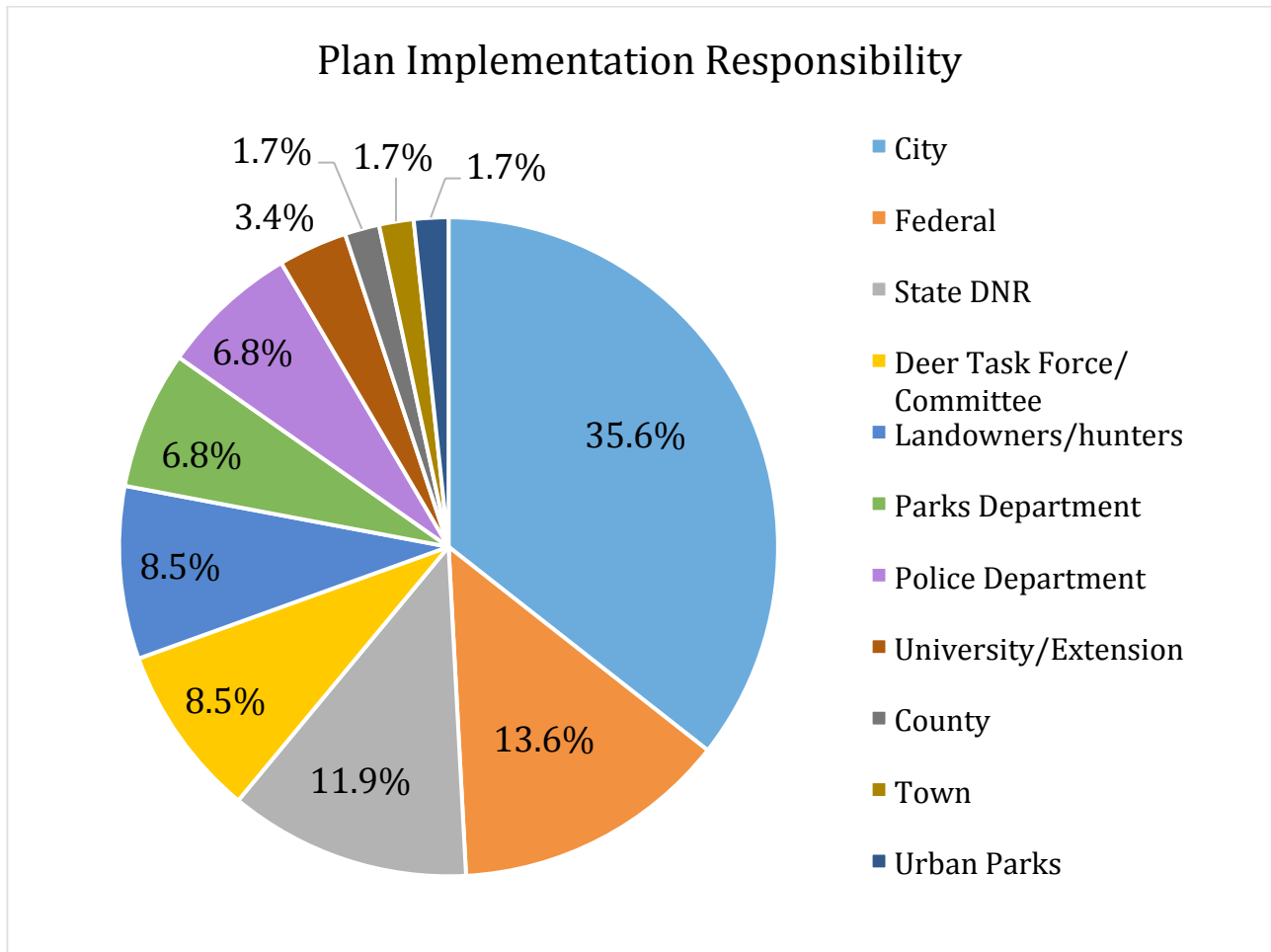


Figure 5: Graphic of the entities responsible for deer management plan implementation.

Additional supporting documents, usually in the form of appendices, are listed in 52% of plans.

Figure 6 includes the supporting documentation that appears at least twice in the coded deer management plans. A full text of ordinances or resolutions appear in 16.1% of the plans while data from deer population estimates are included in 14.3% of plans. Other documentation types that appear only once include; a city invitation, deer browse data, historical deer data, maps, a plant survey, report forms, a sample report, a university study, and a wildlife survey.

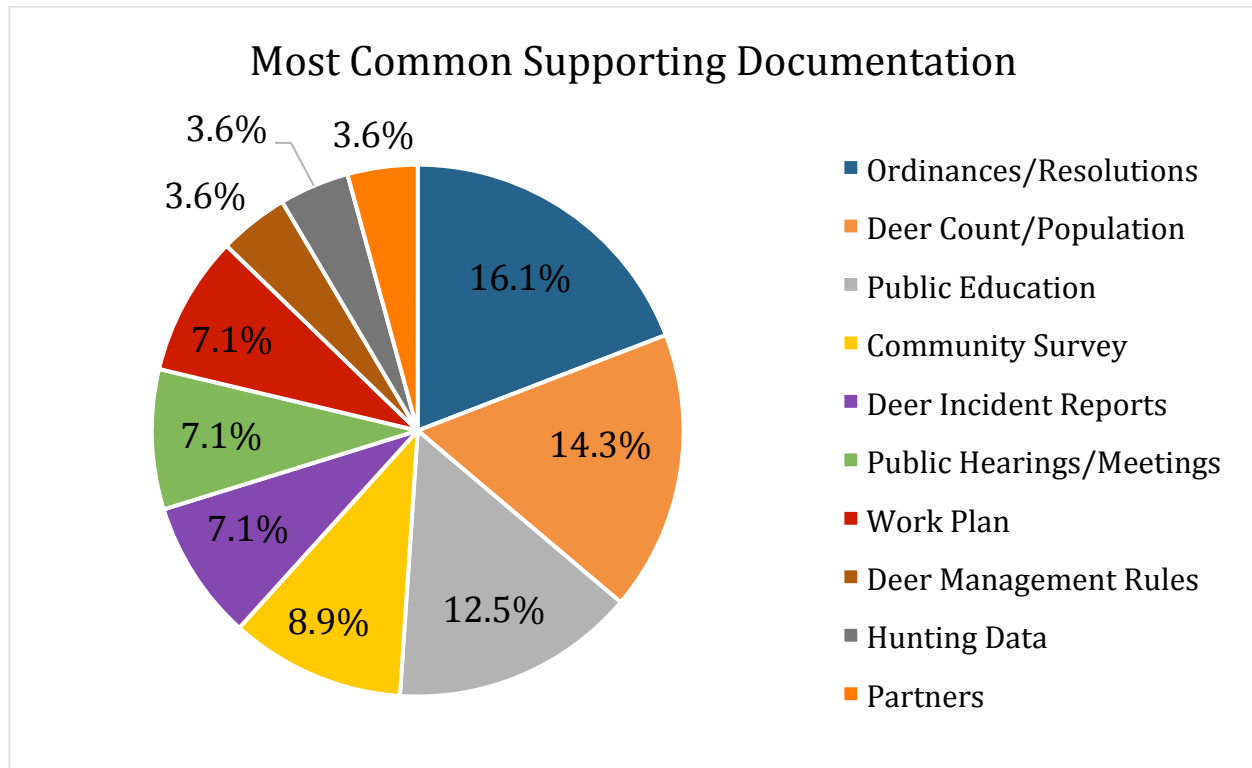


Figure 6: Graphic of the supporting documentation that appeared at least twice in the deer management plans.

Twelve percent of plans included cite documents or articles. Of the plans that had references, the average is about 28 references per plan. References are from:

- Academic Journals
- Books
- City Documents
- Conference Proceedings
- Consultant's Reports
- Expert Communications
- Extension Documents
- Federal Documents
- Field Guides
- Insurance Company Documents
- Magazine Articles
- Masters Theses
- Newspaper Articles
- Other Deer Management Plans
- Practitioner's Guides
- Published Reports

- Software Manuals
- State Documents
- University Reports
- Websites

DISCUSSION

Overall, many of the existing deer management plans are incomplete when compared to the essential elements identified in the coding protocol. Very few have detailed or specific goals or measurable objectives for their deer management program. In contrast, every plan includes actions taken. This outcome is perhaps unsurprising, as anecdotal conversations with deer management experts and wildlife professionals suggests that many communities are eager to implement action (i.e., they are ready to address their deer overabundance problem and want to do so quickly), and may often do so without clearly delineating goals and objectives. However, clear goals and objectives provide the rationale for the selection of particular action(s). It is important that plans identify goals and objectives clearly; community controversy around deer management planning tends to focus on actions selected, and without a clear basis for selecting those actions (i.e., indicating that those actions support particular goals for their community), the controversy may be even more pronounced (Curtis & Hauber, 1997; Decker et al., 2004).

Very few plans include a plan for monitoring and evaluation—especially identifying indicators for measuring objectives. Inclusion of those elements is critical, as they provide a way for communities to assess whether or not their plans are meeting goals and objectives—and if not, they help identify changes that can be made. Related, budgets and timetables are also frequently absent from coded deer management plans; these elements, especially the timetable, provide another way for communities to track progress towards goals, as well as contribute to the overall transparency of the deer program.

By describing the content typically included and missing from community-based deer management plans, this analysis can help to inform the development of an educational module to aid community leaders, process facilitators, and deer management professionals in writing a community-based deer management plan. By identifying some of the gaps in plans (e.g., goals, measurable objectives, a plan for monitoring, budget, and timetable), this analysis provides direction regarding content to emphasize in support of developing comprehensive, well-reasoned plans. As state wildlife agencies and communities continue to rely on local-level processes to address increasing impacts of deer-human interactions (Chase et al., 2000), tools such as a how-to module for developing a community-based deer management plan can be helpful.

Next Steps

Based on the review of 25 deer management plans, it is recommended that an educational module for writing deer management plans be developed. The module should focus on the importance of developing goals and measurable objectives with associated indicators for monitoring, as many of the plans reviewed do not have these elements. The educational module should effectively communicate a clear rationale for why including those elements is a crucial component of a deer management plan. Emphasizing the importance of developing objectives prior to making decisions about actions seems critical. Many of the deer management plans

generally lack detail on why particular actions were taken or decisions were made; an educational module should highlight the importance of including the reasoning behind decisions, as well as the associated data or references that contributed to those decisions. In addition, emphasizing the importance of an associated timeline and budget will be a critical component of an educational module. Upon completion, this educational module should be available as a resource on the Community Deer Advisor website (deeradvisor.org) for communities to use as they update or create new management plans.

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APPENDIX A

Deer Management Plans Coding Protocol

Purpose of Deer Management Plan Coding: To identify the elements of, and to extract examples from, existing deer management plans to create a more robust deer management plan template and to inform the deer management plan training module.

Data will be compiled and collected in Excel.

- **Description of the deer management plan**

Code name	Explanation of the category
Title	Title of plan
Location	Area targeted for management (town, municipality, county, etc.)
Date	Date of plan publication
Source	Name of organization/entity that created the plan
Assistance	Organizations/individuals who provided assistance with the plan
Length	Number of pages (excluding full page photo spreads)

- **The elements of the plan**

1. Background and Summary

Code name	Explanation of the category	Notes for coders
Land Ownership	What is the ownership of the land targeted for management?	• Public land, private, both?
Land Type	What is the type of land targeted for management?	• State park, county park, city park,

		neighborhood, private residence, private forest/woodland, agricultural land (other?)
Size	What is the size of the community?	<ul style="list-style-type: none"> List population size if available.
Plan Summary	Is there a summary of what the plan includes (e.g., actions selected and a general timeline for implementation)?	<ul style="list-style-type: none"> Included in plan: yes/no
Purpose	Does the plan have a purpose?	<ul style="list-style-type: none"> Highlight/copy the statement Note if no purpose is included
Deer History	General history of deer in the impacted area	<ul style="list-style-type: none"> Included in plan: yes/no
Plan History	General information about how the plan came to be (e.g., if the community reached a tipping point that led to a need for a plan, if a deer committee was convened to help create the deer management plan, how committee members were selected (process, by whom, criteria for selection, etc.), important dates or milestones, the decision-making process used to create the deer management plan, etc.)	<ul style="list-style-type: none"> List historic events

2. Problem Definition

Code name	Explanation of the category	Notes for coders
Primary Impacts	Description of the primary impacts driving the problem; (e.g., impacts to habitat, impacts to ornamental plantings around residences, deer-vehicle collisions, increased Lyme disease cases, etc.) ****Second round of coding will categorize the objectives into impact types (e.g., health and human safety, ecological, economic, etc.)	<ul style="list-style-type: none"> List each impact in the plan
When/Where	Details on when and where these impacts are occurring	<ul style="list-style-type: none"> Included in plan: yes/no
Who	Details on who is experiencing the impacts	<ul style="list-style-type: none"> Included in plan: yes/no
Severity	Description of how severe the problems have become	<ul style="list-style-type: none"> Included in plan: yes/no, could be quantified or not

3. Goals and Measurable Objectives

Code name	Explanation of the category	Notes for coders
General Goal	Description of goals or broad objectives of the deer management program. Might be expressed as a list of general outcomes or reflect a desired future condition.	<ul style="list-style-type: none"> List each goal or broad objective separately
Measurable Objective	Detailed quantifiable measurable objectives with time components. **Second round of coding will categorize the objectives into impact types (e.g., health and human safety, ecological, economic, etc.)	<ul style="list-style-type: none"> List each objective in plan
Connected Goal	Are there any goals that are connected to broader goals established outside the community deer management plan (e.g., connected to state-level goals or management?)	<ul style="list-style-type: none"> Included in plan: yes/no

4. Management Actions Recommended and Considered

Code name	Explanation of the category	Notes for coders
Actions Selected	Details of various management actions recommended or selected (e.g., strategies for population control, strategies directed at deer behavior, strategies directed at human behavior, public outreach, education or communication strategies, local ordinance changes etc.)	<ul style="list-style-type: none"> List of action details (after initial coding try to group these into different categories for counts to potentially demonstrate that plans may be more or likely to address one kind of issue over another)
Meet Objectives	Is there a description of how the actions selected will meet objectives of the plan?	<ul style="list-style-type: none"> Included in plan: yes/no
Attain Objectives	Is there a description of who will carry out the objectives, timelines, locations, etc.?	<ul style="list-style-type: none"> For each objective, does it mention who will carry it out (yes/no/some) and is there a timeline associated with it (yes/no)
Actions Considered	Is there any listing or mention of actions considered but not implemented?	<ul style="list-style-type: none"> Included in plan: yes/no

5. Plan for Public Engagement and Monitoring

Code name	Explanation of the category	Notes for coders
Public Outreach	Are there details in the plan that involve informing and engaging community members throughout the process? (e.g., citizen science projects)	<ul style="list-style-type: none"> Included in plan: yes/no
Indicators	Is there a list of indicators used for monitoring progress towards achieving objectives?	<ul style="list-style-type: none"> Included in plan: yes/no
Indicator Details	Do the indicators include specific data to be collected, who is going to collect those data, and how they will do so?	<ul style="list-style-type: none"> Included in plan: yes/no
Connected Indicator	Are the indicators connected to the specific objectives?	<ul style="list-style-type: none"> Included in plan: yes/no

6. Budget and Timetable

Code name	Explanation of the category	Notes for coders
Budget	Does the plan have a budget?	<ul style="list-style-type: none"> Included in plan: yes/no
Costs	Does the budget include one-time and recurring costs?	<ul style="list-style-type: none"> Separate yes/no for one-time costs and for recurring costs.
Elements of Budget	What things are covered in the budget (e.g., costs for sharpshooters, outreach and education, etc.)?	<ul style="list-style-type: none"> List elements
Timeline	Does the plan have a timeline?	<ul style="list-style-type: none"> Included in plan: yes/no
Elements of Timeline	What elements are included in the timeline (e.g., data collection, community meetings, future mileposts, adaptive management to refine decisions etc.)?	<ul style="list-style-type: none"> List elements

7. Responsibilities and Additional Supporting Documents

Code name	Explanation of the category	Notes for coders
Responsibility	Does the plan indicate the responsible party for each element of it?	<ul style="list-style-type: none"> All/None/Some
Responsible	Affiliations of all mentioned as a responsible party in the plan.	<ul style="list-style-type: none"> List all affiliations

Party		
Documents	Does the plan include any additional supporting documents?	<ul style="list-style-type: none"> Included in plan: yes/no
Document List	What supporting documentation is included?	<ul style="list-style-type: none"> List names and describe document type

8. Additional information

Code name	Explanation of the category	Notes for coders
References	<p>What documents does the plan reference?</p> <p>**Secondary coding, sort references into types: journal article, extension pub, other community documentation etc.</p>	<ul style="list-style-type: none"> Count and list

APPENDIX B
Community-Based Deer Management Plan Template
for

[City, State]

This is a template to help you recognize the important components of a deer management plan. As you browse the example deer management plans included on this website, you will find that they do not follow a standard format. Some plans are hundreds of pages long with many appendices, whereas others are simple 10-page documents. Some states may require that communities undergo an environmental impact assessment process prior to implementing a program, which may affect the length of a plan and the components of that plan. However, what we have included in this template are the core elements that a deer management plan should include no matter the length.

BACKGROUND AND PLAN SUMMARY

Here is where you might provide some background regarding your community or a description of the area targeted for management, e.g., location, size, etc. You may also provide a brief summary of the deer management plan, e.g., actions selected and a general timeline for implementation. If a deer committee was convened to help create the deer management plan, include some information about a) how committee were selected (process, by whom, criteria for selection, etc.); b) committee members names and affiliations; c) important dates or milestones; d) the decision-making process used to create the deer management plan.

PROBLEM DEFINITION

Here is the place to describe the deer management problem that your community is facing. Include a discussion of the primary impacts that are driving the problem; these might include impacts to habitat, impacts to ornamental plantings around residences, or perhaps public health and safety impacts such as deer-vehicle collisions or increased Lyme disease cases. Describing the impacts that are driving the problem in your community will help readers of your plan understand the links between the management actions your committee selected, the objectives those actions help meet, and the impacts those objectives help address.

GOALS

Include here some broad goals that you hope to achieve with your deer management program. These goals might be expressed as a list of general outcomes or reflect a desired future condition. Example goals might be maintaining a socially-acceptable level for the deer population; preserving healthy, local forestland; supporting a community that is well-educated on how to live with deer while reducing human-deer conflicts, etc. These goals should be realistic and achievable.

MEASURABLE OBJECTIVES

Here is where you include your measurable objectives, the achievement of which collectively allow accomplishment of your goals for deer management in your community. It may be helpful to think about your objectives in terms of categories, such as: objectives directed towards the number/behavior of deer, objectives directed towards increasing community knowledge about deer/deer management (e.g., driving behavior, deer-resistant plantings, etc.). Example objectives might be to reduce the number of deer-vehicle collisions to a certain amount per year, to eliminate deer damage to ornamental plantings around homes, to increase or maintain stems of certain forest plant species to some density, etc. Whatever objectives you have identified, it is important that they be measurable and have a time component (target date for achievement), meaning that there is a way for you to track progress towards meeting these objectives. In the following sections, you will identify your selected management actions as well as selected indicators for monitoring progress on your plan, both of which need to reflect these objectives. As you identify your objectives, be aware of the kinds of actions you might need to take to make progress towards these objectives as well as the kinds of data that you might need to collect in order to evaluate that progress.

MANAGEMENT ACTIONS RECOMMENDED

Here is where you outline the various management actions recommended or selected for your community-based deer management program. These actions may include strategies for population control, strategies directed at deer behavior, strategies directed at human behavior, public outreach, education or communication strategies, local ordinance changes or others. Likely your plan will include a suite of management actions, so you may choose to organize them according to type (e.g., deer population control, ordinances, etc.) For each action selected, it is important that you explain how this action will contribute towards meeting your objectives, identify who will carry out the action, and describe the site targeted for management, if applicable. For instance, if you will be installing deer-proof fencing around various natural areas in your community, which natural areas will be protected and if not all at once, then in what order? And who will be doing the installation? It is important that this section is complete and clear, as controversy around deer management in communities is often focused on management actions.

MANAGEMENT ACTIONS CONSIDERED

Were there actions that your community considered prior to selecting the management actions outlined above? If so, an explanation of which actions were considered and why they were ultimately not recommended provides an important part of the rationale for your implementation plan. Be as specific as possible. For example, if deer immunocontraception was a popular choice among residents but the deer committee found it not to be feasible in your community, make sure you clearly explain why. Was it cost? Effectiveness? Time expected for results? If a management action was considered and rejected, the reasons why should be communicated here.

PLAN FOR PUBLIC ENGAGEMENT

Here is the place to include plans for public outreach regarding your deer management program. You may have included outreach strategies as part of your selected management actions to meet education-related objectives (e.g., holding neighborhood workshops on landscaping with deer-resistant plantings), but if there are additional steps that will be taken towards engaging community members, here is the place to describe those steps. For instance, do you plan on holding annual or semi-annual public meetings to update the community on progress towards your plan? Will you be maintaining a page on your community's municipal website regarding the deer management program? Keeping the public apprised of changes to your deer management program or progress towards goals and objectives is an important aspect of effective CBDM efforts, and having a place in your plan where you can explicitly identify how you will do so is one way to stay accountable.

PLAN FOR MONITORING

Here is where you should include a list of the indicators you will be monitoring to assess progress towards achieving your objectives. It is important to identify for each indicator what specific data you are going to collect, who is going to collect those data, and how they will do so. For instance, will your community be conducting aerial counts of deer each year to monitor changes in population? Will you be monitoring regeneration of certain forest plants? Tracking deer-vehicle collisions? Whatever your community will be doing to evaluate your deer management program's progress towards addressing important impacts, it is critical that the indicators you have selected are clearly identified and are tied to measurable objectives.

BUDGET

Include here the estimated costs of each element of your community's plan for each year that the effort is funded. Identify both one-time costs as well as ongoing costs. Be sure to be as comprehensive as possible; costs such as hiring a firm to conduct sharpshooting for deer population control, for instance, may be easy to identify. However, do not forget about other potential costs such as those associated with outreach and education.

TIMETABLE

Include here an anticipated timetable for the various components of your deer management plan. When are different management actions scheduled to be completed? When do you intend to collect data for monitoring and evaluation, and over what time horizon? Do you have any annual public meetings scheduled where progress on your deer management program might be shared with the community? Remember, it is important that if changes are made to your program, you revise your timeline accordingly.

RESPONSIBILITIES

For each activity included in your deer management plan, someone or some entity should be identified as the responsible party for carrying out that activity. Of course, they should be aware of and have agreed to that responsibility (e.g., who is responsible for collecting monitoring data?). You may identify that person or entity in the corresponding section of the plan, or you may use this space to outline those responsibilities.

ADDITIONAL SUPPORTING DOCUMENTS

Here is where you might attach any additional supporting documents for your plan. For instance, if some data were collected early on in your process (e.g., aerial deer population counts, a survey of community member attitudes, etc.), you might include that information and results as an attachment.

APPENDIX C

Additional Sources Mentioned in Deer Management Plans

- Anecdotal
- Animal Control
- City
- County
- Expert
- Highway Administration
- Humane Society
- Management Group
- National Historical Park
- Non-profit
- Other Deer Management Plans
- Planning Commission
- State Council of Governments
- Urban Farmers
- USDA
- Working Committee